CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Sediment in the Gulf of Thailand can be divided into 2 groups based on the different in depositional environment which are the Upper Gulf and the Lower Gulf. The Upper Gulf is under the direct influence of 4 major rivers namely Chao Phraya, Ta Chin, Mae Klong and Bang Pakong discharging into it. Most of the suspended load carried by these rivers will deposit in the Upper Gulf at a very high sedimentation rate of 3.3-8.9 mm/yr. The Lower Gulf, on the other hand, is influenced by the materials transported from the South China Sea. The sedimentation rate here is relatively lower.

With the grain-size composition the Gulf sediment can be classified into 7 types and the most abundance are sandy clayey silt, silty sand and clayey silt. Generally speaking, the bottom of the Gulf of Thailand is covered mainly with silt with the exception of the areas along the east coast of the Upper Gulf and the head of the Lower Gulf which are sandy.

The most abundant clay mineral found in the Gulf is iliite. The content of illite and chlorite tend to be higher and are relatively more abundant than montmorillonite in the Upper Gulf. Montmorillonite and chlorite are equally abundant in the Lower Gulf. Kaolinite is uniformly distributed throughout the Gulf. The clay mineral distribution appears to have been strongly influenced by regional geology and soil formation of the bordering land areas. The

Gulf itself can be divided according to the different in clay mineral composition of sediment found into 4 provinces.

Fe, Mn, organic matter in the Upper Gulf sediment are higher than these found in the Lower Gulf sediment. Carbonate content is found to be low (<10%) in sediments lying along the coast on both sides of the Gulf with no relationship between the content and grain size.

The oragnic matter found in sediments is likely to be present as coating on the surface of Fe-, Mn-oxyhydroxides and the content is higher in the sediments having high percentage of fine-grained particles.

Relationship between geochemical and geological properties of sediment and the leachable metal contents shows that Cd, being the least abundant element among the three elements studied, is not preferentially sorbed on any fraction and tends to have very low concentration in every fractions. Cr and Zn shows relatively the same partitioning pattern of favourably associated with every fractions.

The pattern of partitioning becomes clearer with the help of sequential leaching study. Cd is equally distributed between non-residual and residual fraction and its partitioning in non-residual fraction is in the order of exchangeable, carbonate and sorbed > oxyhydroxides ≥ organic bound. Cr and Zn are found to be bound in relatively higher amount in residual fraction than in non-residual fraction. Cr is partitioned in non-residual fraction in the order of organic bound > exchangeable, carbonate and sorbed ≥ oxyhydroxides while the pattern of Zn is organic bound > oxyhydroxides > exchange-

able, carbonate and sorbed.

In designing a successful sequential leaching method one must take the followings into consideration : disaggregation; mixing of sample and leach; buffered extractant; readsorption; temperature and time; extraction sequence and; chemical reactivity and kinetic effects. Under controlled experimental conditions sediment : extractant ratio and strength of extractants are varied and tested. The method designed is

EXTRACTANTS	RESULTANT FRACTION
a) NaOAc (1.0 M) + HOAc, pH 5.0	carbonate, sorbed (and salt)
b) $NH_2OH \cdot HCl$ (1.0 M) + Na-citrate (0.175 M), pH 5.0	oxyhydroxides
c) H_2O_2 acidified to pH 2.0, NH_4OAc	organic bound
d) $HF-HNO_3-HClO_4$ at 200 ^{o}C	residual

It is found that Cd, Cr and Zn can not be extracted completely from carbonate fraction at sediment : extractants ratio higher than 1 : 20 at the extractant strength not less than. Incompleted extraction will cause cross contamination. The stength of oxyhydroxide and organic extractant are high enough at sediment : extractant ratio of 1 : 20 to completely extract metals associated with these fractions providing that there is no cross contamination from the previous fraction high enough to cause overloading in the subsequent fractions.

It is obvious that other experimental parameters are yet to be investigated. Kinetics should be the first priority because the time of extractions for each fraction are rather long. Optimizing time of extraction should be able to make the techniques less time consuming and much more practical. In addition, the technique should be further tested with various types of near-shore sediments having higher and lower metal concentrations than the ones tested in this study. This kind of study should yield a result on capacity of each extractants enough to completely extract metals from different types of near-shore sediments, thus, making the techniques more versatile and avoiding cross contamination.

Validation of the technique is still a serious problem due to unavialability of any certified reference materials. The best possible alternative, at present, is by preparing a set of reference samples. The reference samples should compose of near-shore sediments of different compositions which have been repetitively analyzed for their metal contents in various fraction by this developed technique. After average values of metal contents are established, at least a reference sample must be analyzed together with every batch of sample.

Various works have given supporting evidence that exchangeable fraction is seriously affected by the methods of storage and preparation. This study has assumed that exchangeable metals are lost during sample preparation by changing into soluble form, thus, extracting exchangeable fraction together with carbonate fraction should bring soluble, exchangeable and carbonate fractions into solution. No matter how this assumption is theoretically justified, it should be given further investigation.

In contrast to studying metal partitioning by sequential extraction method, one may try to calculate the extent of metal partitioning from the amout of carbonate, oxyhydroxides, and organic matters that stoichiometrically react with metals. This approach is very interesting and should receive further consideration.